3.0 AFFECTED ENVIRONMENT

This chapter describes the natural and human environment that could be affected by the Proposed Action and the alternatives. Table 1 identifies the subsection where potential environmental issues are discussed or notes why they are not addressed in this document.

Table 1. Potential Environmental Issues Applicable to this EA

Environmental Category	Applicability	Subsection
Waste Management	Yes	3.2
Air Quality	Yes	3.3
Floodplains and Wetlands	Yes	3.4
Biological Resources	Yes	3.5
Cultural Resources	Yes	3.6
Geology	Yes	3.7
Water Resources (Ground and Surface)	Yes	3.8
Human Health	Yes	3.9
Noise	Yes	3.10
Traffic and Transportation	Yes	3.11
Visual Resources	Yes	3.12
Land Use	No. Land uses and land use designations would not be affected as a result of the Proposed Action or alternatives.	N/A
Utilities and Infrastructure	No. Utilities and infrastructure would not be affected as a result of the Proposed Action or alternatives.	N/A
Socioeconomic	No. Demolition activities would employ only 20 new workers at the peak activity and would have little noticeable effect on local economy.	N/A
Environmental Justice	No. Populations that are subject to environmental justice considerations are not located within the area of influence of the Proposed Action or alternatives.	N/A

3.1 Regional Setting

The Proposed Action would be located within the area of Santa Fe and Los Alamos Counties that include LANL. LANL comprises a large portion of Los Alamos County and extends into Santa Fe County. LANL is situated on the Pajarito Plateau along the eastern flank of the Jemez Mountains and consists of 49 technical areas. The Pajarito Plateau slopes downward towards the Rio Grande along the eastern edge of LANL and contains several fingerlike mesa tops separated by relatively narrow and deep canyons.

The FRS is constructed within Pajarito Canyon about 800 ft (240 m) below the joining of Two-Mile Canyon with Pajarito Canyon (Figure 17). The structure is approximately 2 mi (3.2 km) above the TA-18 facilities, which house the criticality experimental facilities, and about 10 mi (16 km) above the community of White Rock. The bottom of the canyon is a 100-year floodplain. Pajarito Canyon contains core and buffer area of environmental interest (AEI) for the Mexican spotted owl (*Strix occidentalis lucida*); this is currently unoccupied foraging habitat.

The low-head weir is located at the eastern edge of LANL in Los Alamos Canyon (Figure 18). The road reinforcements are located in the western area of LANL in Two-Mile Canyon at SR 501 and Anchor Ranch Road, in Pajarito Canyon at SR 501, and in Water Canyon at SR 501 (Figure 19). The steel diversion wall is located in Pajarito Canyon approximately 2 mi (3.2 km) below the FRS just above CASA 1 in TA-18 (Figure 20).

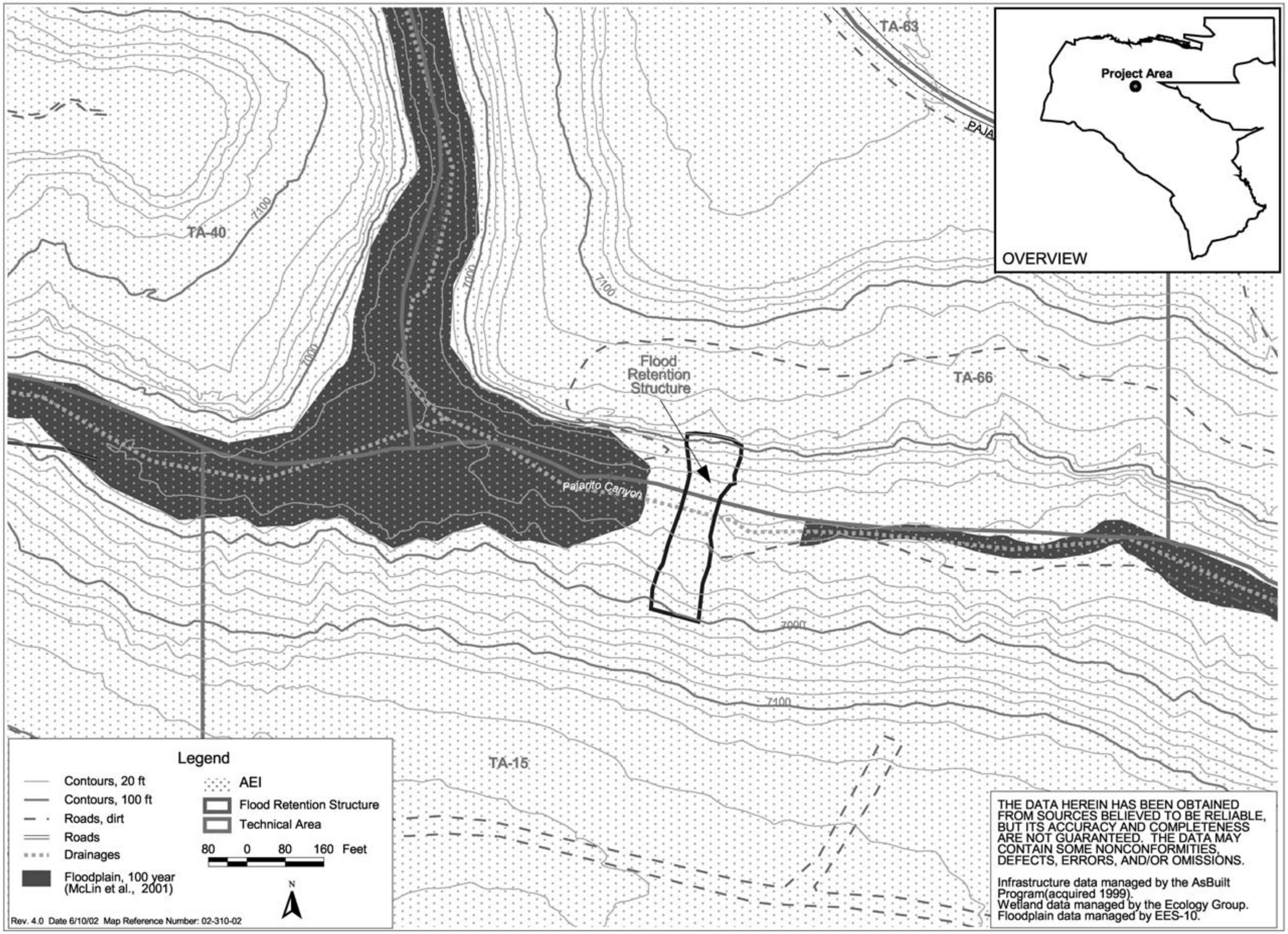

Figure 17. Location of FRS in Pajarito Canyon.

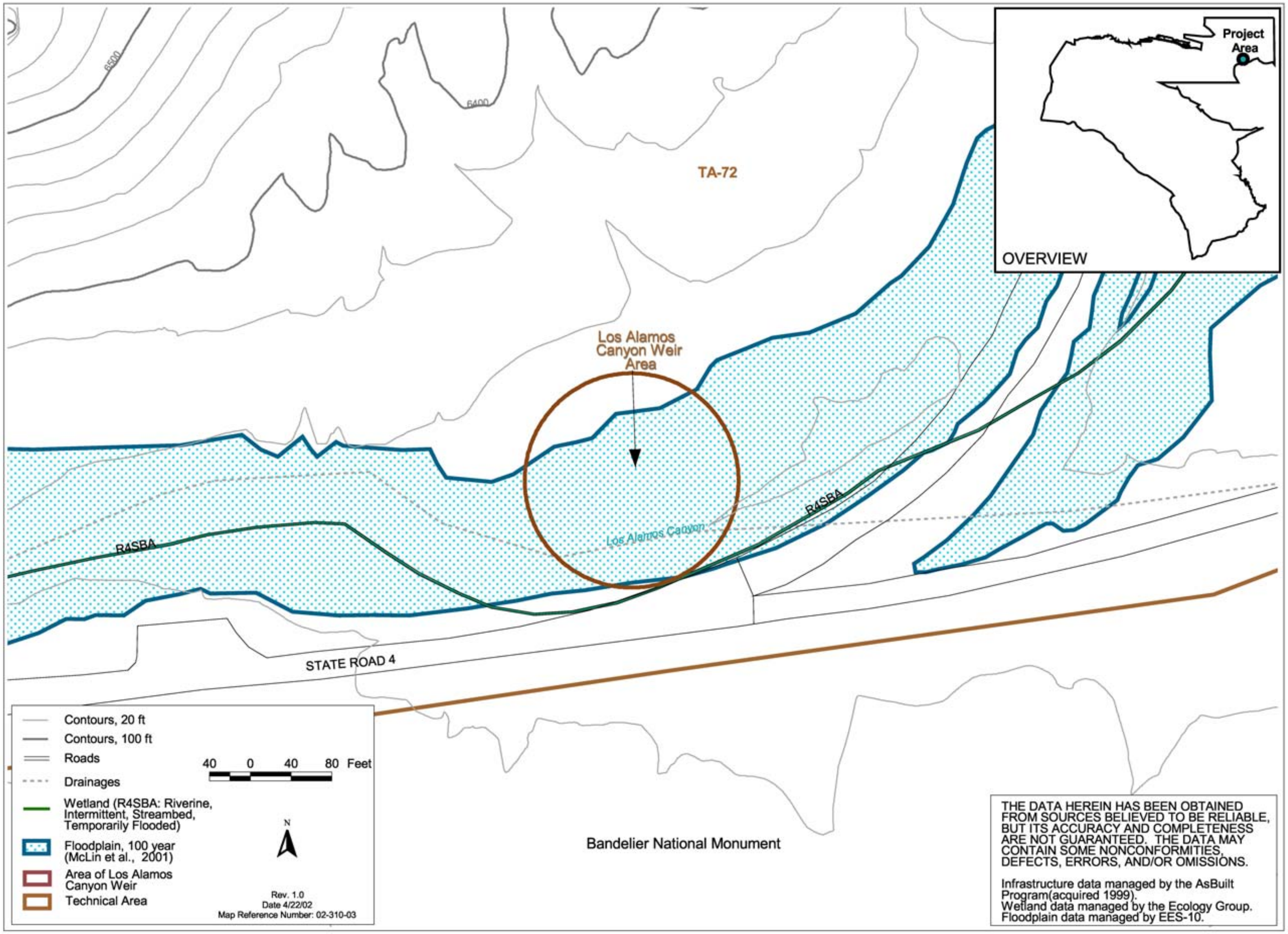

Figure 18. Location of low-head weir in Los Alamos Canyon.

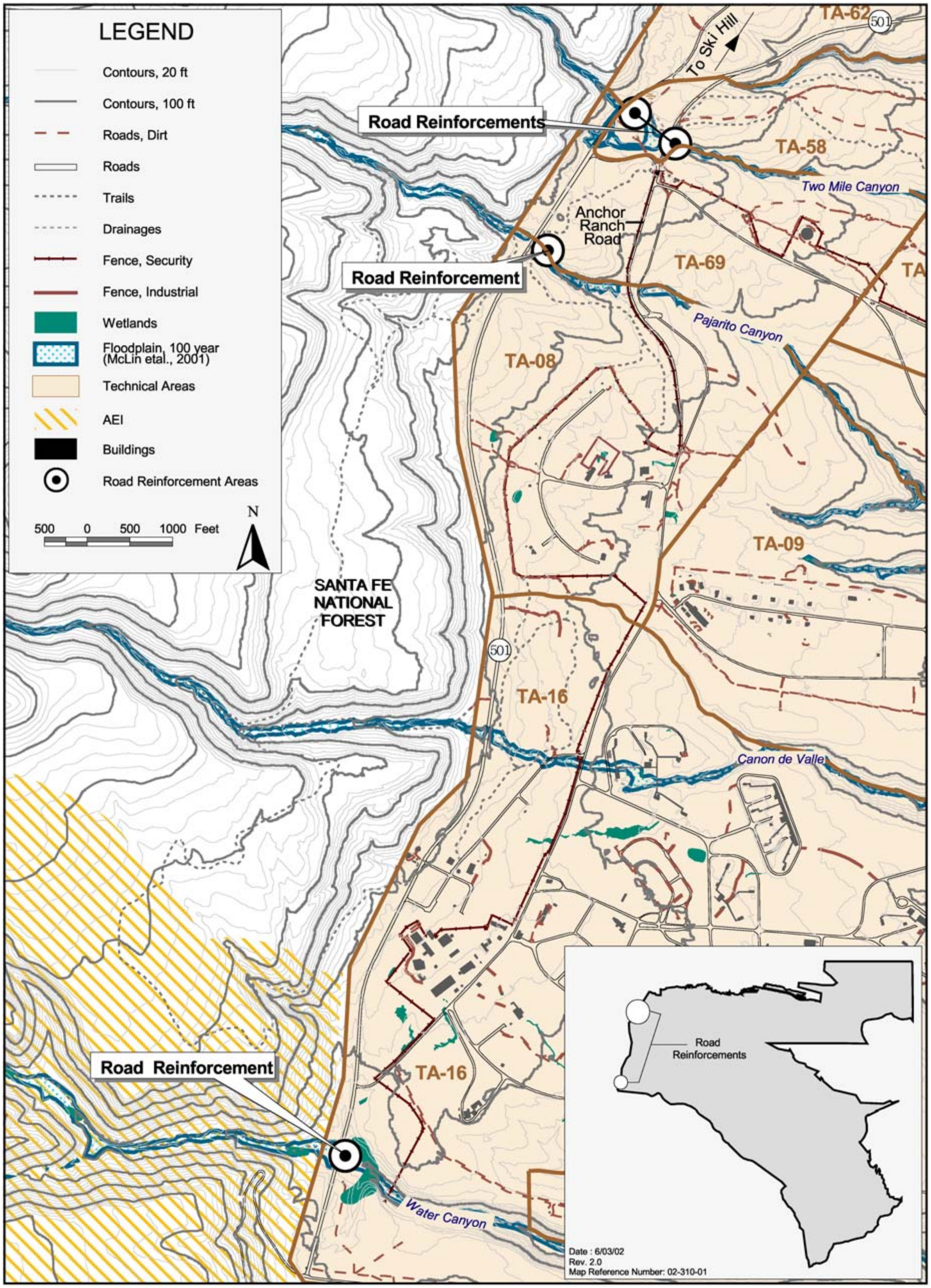

Figure 19. Location of road reinforcements in Two-Mile Canyon, Pajarito Canyon, and Water Canyon.

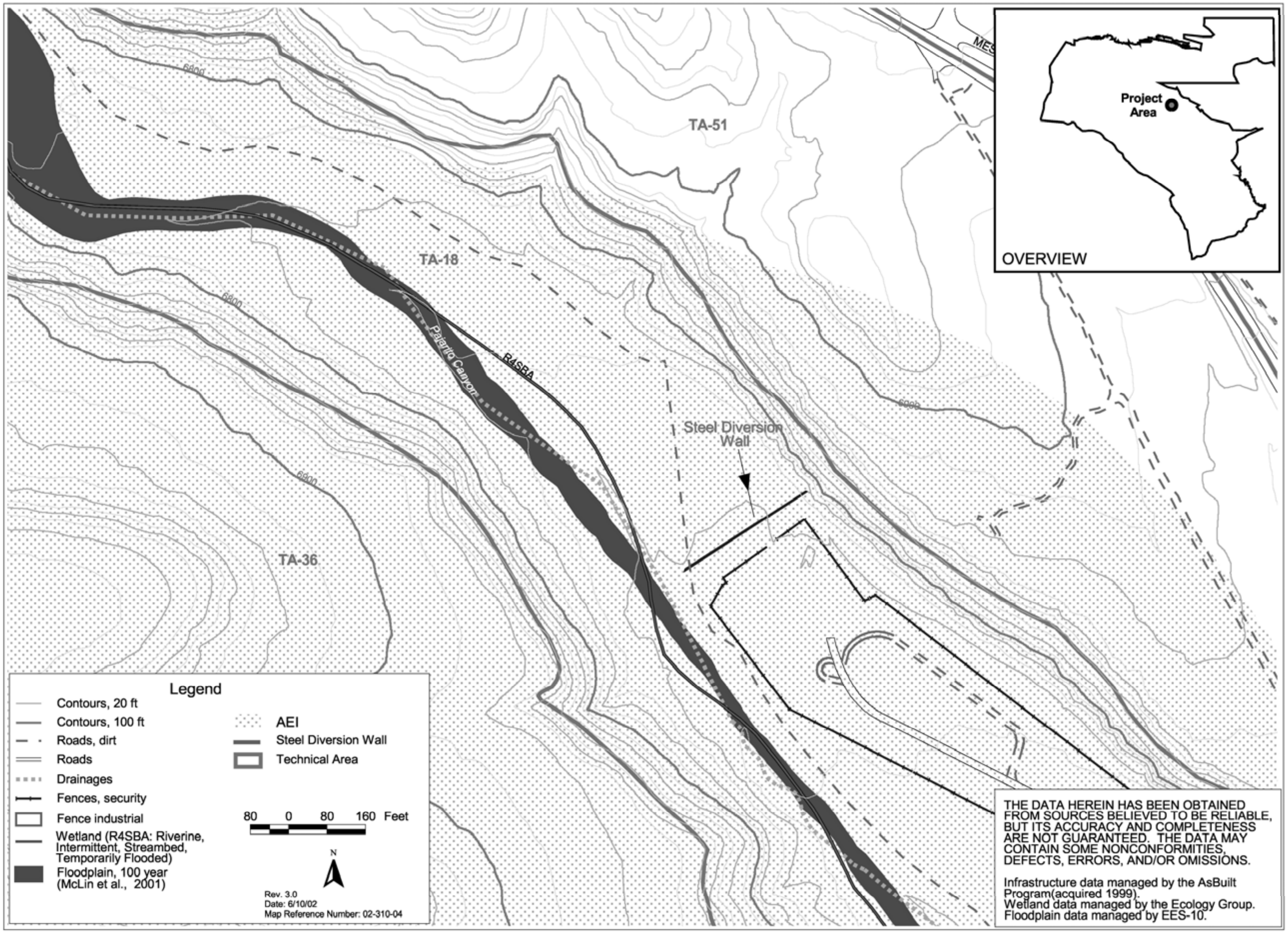

Figure 20. Location of steel diversion wall in Pajarito Canyon above TA-18.

3.2 Waste Management

LANL generates solid waste[5] from construction, demolition, and facility operations. These wastes are managed and disposed of at appropriate solid waste facilities. Both LANL and Los Alamos County use the same solid waste landfill located within LANL boundaries on DOE land. The Los Alamos County Landfill also accepts solid waste from other neighboring communities. The Los Alamos County Landfill receives about 52 tons per day (47 metric tons per day), with LANL contributing about 8 tons per day (7 metric tons per day), or about 15 percent of the total. Current plans are to close the Los Alamos County Landfill by June 30, 2004. Several landfill locations within New Mexico could be used after 2004.

Building-debris storage yards on Sigma Mesa (TA-60) or other approved areas are used at LANL to store concrete rubble, soil, and asphalt debris for future use at LANL. Low-level radioactive waste is disposed of at LANL, in Area G at TA-54, or is shipped to appropriate permitted facilities. Hazardous waste[6] and mixed wastes are treated and disposed of offsite because LANL has no onsite disposal capability for these waste types. The offsite disposal locations are located across the U.S. and are audited for regulatory compliance before being used by UC.

Ash and sediments resulting from post-fire runoff have been used by the U.S. Forest Service to raise the roadbed of its road in Los Alamos Canyon. The remaining sediments have been stockpiled in borrow-pits at TA-16 to be used for future construction and fire roads. Sediment accumulated at the FRS is not expected to be contaminated. PRSs located upstream of the FRS in Two-Mile Canyon and Pajarito Canyon have been stabilized. In addition, PRSs that formerly discharged into Pajarito Canyon have been stabilized. These include outfalls, surface runoff, and dispersion from firing sites.

3.3 Air Quality

Air quality is a measure of the amount and distribution of potentially harmful pollutants in ambient air[7]. Air surveillance at Los Alamos includes monitoring emissions to determine the air quality effects of LANL operations. UC staff calculates annual actual LANL emissions of regulated air pollutants and reports the results annually to the New Mexico Environment Department (NMED). The ambient air quality in and around LANL meets all Environmental Protection Agency (EPA) and DOE standards for protecting the public and workers (LANL 2001a).

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[5] Solid waste, as defined in the Code of Federal Regulations (40 CFR 261.2) and in the New Mexico Administrative Code (20 NMAC 9.1), is any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities.

[6] Hazardous waste, as defined in 40 CFR 261.3, which addresses Resource Conservation and Recovery Act regulations, and by reference in 20 NMAC 4.1, is waste that meets any of the following criteria: a) waste exhibits *any* of the four characteristics of a hazardous waste: ignitability, corrosivity, reactivity, or toxicity; b) waste is specifically *listed* as being hazardous in one of the four tables in Subpart D of the CFR; c) waste is a mixture of a *listed* hazardous waste item and a nonhazardous waste; d) waste has been *declared* to be hazardous by the generator.

[7] Ambient air is defined in 40 CFR 50.1 as "that portion of the atmosphere external to buildings, to which the public has access." It is defined in the New Mexico Administrative Code (20 NMAC 2.72) as "the outdoor atmosphere, but does not include the area entirely within the boundaries of the industrial or manufacturing property within which the air contaminants are or may be emitted and public access is restricted within such boundaries."

Both EPA and NMED regulate nonradioactive air emissions. NMED does not regulate dust from excavation construction, but UC would take appropriate steps to control fugitive dust and particulate emissions. Annual dust emissions from daily windblown dust are generally higher than short-term construction-related dust emissions.

Excavation and construction activities are not considered stationary sources of regulated air pollutants under the New Mexico air quality requirements. Mechanical equipment associated with the construction phase of this project, including bulldozers, trenchers (trackhoes), excavators, side booms, tamper compactors, forklifts, and backhoes are exempt from permitting. Mobile sources, such as automobiles and construction vehicles, are additional sources of air emissions such as nitrogen oxide (NO_x); however, mobile sources and diesel emissions from conveyance vehicles are not regulated by NMED.

3.4 Floodplains and Wetlands

Wetlands are transitional lands between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands must have the following attributes: at least periodically, the land supports primarily hydrophytes (plants adapted to abundant water such as cattails [*Typha* spp.] and willows [*Salix* spp.]), the substrate is predominantly undrained hydric soil (e.g., marshes, wet meadows); and is saturated with water or covered by shallow water at some time during the growing season of each year. LANL has wetlands that were identified by the National Wetlands Inventory, conducted by the U.S. Fish and Wildlife Service in 1990, as well as other wetlands that have been identified subsequent to the 1990 inventory. There are a total of 77 ac (31 ha) of wetlands at LANL, with more than 95 percent of these located in the Sandia, Mortandad, Pajarito, and Water Canyon watersheds. During the Cerro Grande Fire, 20 percent or 16 ac (6.5 ha) of the wetlands identified were burned at a low or moderate intensity; none of the wetlands within LANL was severely burned (DOE 2000a).

The DOE/SEA-03 (DOE 2000a) discusses cumulative effects due to erosion, contaminant transfer and flooding in the wetland areas due to actions taken after the Cerro Grande Fire. Wetlands in Mortandad, Pajarito and Water Canyons received increased amounts of ash and hydro mulch runoff as a result of the fire (LANL 2001d).

DOE's regulations (10 CFR 1022) define a flood or flooding as " . . a temporary condition of partial or complete inundation of normally dry land areas from . . . the unusual and rapid accumulation of runoff of surface waters. . . ." The base floodplain is the area inundated by a flood having a 1.0 percent chance of occurrence in any given year (referred to as the 100-year floodplain). The critical-action floodplain is the area of inundated by a flood having a 0.2 percent chance of occurrence in any given year (referred to as the 500-year floodplain). DOE had delineated all 100-year floodplains within LANL boundaries before the Cerro Grande Fire; review of these delineations is part of the post-fire recovery effort. The results of this review have recently been published (McLin 2001).

The FRS is located above TA-18 within the floodplain of Pajarito Canyon 800 ft (240 m) downstream of the confluence of Two-Mile and Pajarito Canyons. The steel diversion wall is located outside the Pajarito Canyon floodplain. The floodplain covers the entire extent of the canyon from the headlands to White Rock. Small wetlands exist in Pajarito Canyon from below TA-18 to above White Rock that provide limited wetland functions. These wetlands have been degraded recently through construction activities and as a result of the Cerro Grande Fire.

The low-head weir is located in Los Alamos Canyon. The entire length of Los Alamos Canyon is considered a floodplain. There are no existing wetlands in this canyon, although there are areas of hydrophilic (water-loving) plants along the stream channel. Wetland characteristics may form in the sediment behind the low-head weir. Currently, cottonwoods (*Populus* spp.) and willows planted in late 2000 are growing in this area. Further sedimentation is expected to occur and, if there is adequate moisture, this area may become a fully established wetland. However, if runoff does not occur, the wetland plants are not expected to thrive and the potential wetland would likely disappear. The size of this potential wetland makes it unlikely that it would provide more than very limited wetland functions should it survive over time.

3.5 Biological Resources

LANL is located in a region of diverse landform, elevation, and climate—features that contribute to producing diversified plant and animal communities. Plant communities range from urban and suburban areas to grasslands, wetlands, shrublands, woodlands, and mountain forest. These plant communities provide habitat for a variety of animal life. Animal life includes herds of elk (*Cervus elychus nelsoni*) and deer (*Odocileus hemionus*), bear (*Ursus americanus*), mountain lions (*Felis concolor*), coyotes (*Canis latrans*), rodents, bats (*Euderma* spp.), reptiles, amphibians, invertebrates, and a myriad of resident, seasonal, and migratory bird life. In addition, threatened and endangered species of concern, and other sensitive species occur at LANL. Because of restricted access to certain LANL areas, lack of permitted hunting, and management of contiguous Bandelier National Monument and Forest Service lands for natural biological systems, much of the region functions as a refuge for wildlife.

A number of regionally protected and sensitive (rare or declining) species have been documented in the LANL region. These include three Federally listed endangered species: the whooping crane (*Grus americana*), the southwestern willow flycatcher (*Empidonax trailii extimus*), and the black-footed ferret (*Mustela nigripes*), and two Federally listed threatened species: the bald eagle (*Haliaeetus leucocephalus*) and the Mexican spotted owl (*Strix occidentalis lucida*). Under the *Endangered Species Act of 1973* (16 USC 1531), government agencies are required to consider the potential effects of all its activities on Federally listed threatened or endangered species and their critical habitat.

The LANL Threatened and Endangered Species Habitat Management Plan (HMP) establishes AEIs that are being managed and protected because of their significance to biological or other resources (LANL 1998). Habitats of threatened or endangered species that occur or may occur at LANL are designated as AEIs. In general, an AEI consists of a core area that contains important breeding or wintering habitat for a specific species and buffer area around the core area. The buffer protects the area from disturbances for certain activities, including construction, in the AEI. For instance, activities are restricted in a core and buffer area during breeding season until it is determined that the habitat is not occupied for that year. LANL UC personnel perform annual surveys of the AEI early in the breeding season to determine the presence of breeding pairs. If the habitat is occupied, the restrictions remain in place until the completion of the breeding season. Any activities that cannot operate within the guidelines of the HMP require further consultation with the U.S. Fish and Wildlife Service.

The FRS is located 800 ft (240 m) downstream from the confluence of Two-Mile and Pajarito Canyons. The area immediately surrounding the FRS is mixed conifer (ponderosa pine [*Pinus ponderosa* P. & C. Lawson], Douglas fir [*Pseudotsuga menziesii* (Mirbel) Franco], and white fir

[*Abies concolor* (Gord. & Glend.) Lind. Ex Hildebr.]). The north-facing slope has numerous trees, which were severely burned during the Cerro Grande Fire. At the time the FRS was constructed, many of these burned trees were downed and left perpendicular to the slope to slow down storm water runoff and soil wash from the slope areas. At the canyon bottom on the upstream side of the FRS, the vegetation has been completely removed and only the steep banks with hydromulching remain along the walls surrounding the utility road. These walls were cut too steep and, despite erosion control measures taken after the structure was constructed (hydromulching), the walls are beginning to erode. These steep banks continue upstream ending near the confluence of the two canyons where live native vegetation remains. About one-half of the trees at this juncture are burned. The burned trees in this area tend to follow Pajarito Canyon. Further up Two-Mile Canyon, the number of burned trees becomes less.

Downstream from the FRS, the first 100 ft (30 m) of the canyon bottom consists of deposited sediment. Most of this appears to have come from the FRS structure itself. The visibility of this sediment starts to fade away after about 200 to 300 ft (60 to 90 m). The slopes on this side of the structure are also showing erosion problems despite the initial hydromulching. These erosion problems will be corrected on both sides of the structure in the near future.

The steel diversion wall is located at TA-18 approximately 2 mi (3.2 km) downstream of the FRS. The area surrounding the steel diversion wall is mixed conifer. This area of the canyon was also burned in the Cerro Grande Fire and evidence of that still remains.

Both the FRS and the steel diversion wall are located in potential habitat AEIs for the Mexican spotted owl, although at this time this potential habitat is not occupied by individuals of the species. If the habitat should be occupied, restrictions on activities within the AEI may be extended to the end of the breeding season (late August).

The vegetation in the areas along SR 501 where road reinforcements have been installed is mainly ponderosa pine with some native grasses. All of the sites of road reinforcements are in areas that were burned during the Cerro Grande Fire.

The low-head weir is located at the junction of SR 502 and SR 4. This area is mainly piñon-juniper (*Pinus* spp. and *Juniperus* spp.) habitat; however, since this weir was constructed, a wetland has started forming on the west, or upstream side. Vegetation consists of cottonwoods and willows planted in the detention base following the fire to help prevent erosion and retain sediment. Over time, this wetland may continue to develop and mature if there is adequate soil moisture. The developing wetland is approximately one-quarter acre in size.

3.6 Cultural Resources

Cultural resources include any prehistoric sites, buildings, structures, districts, and other places or objects considered to be important to a culture or community for scientific, traditional, religious, or any other reason. They combine to form the human legacy for a particular place (DOE 1999). To date, over 2,000 archaeological sites and historic properties have been recorded at LANL.

The criteria used for evaluating cultural resources depends upon their significance as sites eligible for listing to the National Register of Historic Places (NRHP) as described in the *National Historic Preservation Act* (16 United States Code 470). These determinations of significance are met by evaluating each cultural resource based on its meeting any one or more of the following criteria:

1. Associated with events that have made a significant contribution to the broad pattern of our history.
2. Associated with the lives of persons significant in our past.
3. Illustrates a type, period, or method of construction.
4. Yields, or may be likely to yield, information important in prehistory or history.

There are three prehistoric sites located in the area of the FRS. These sites consist of an Ancestral Pueblo petroglyph panel and two rock shelters of an unidentified affiliation. The petroglyph panel is upstream of the FRS, whereas the two rock shelters are downstream of the FRS. All three sites are approximately 30 ft (9 m) above the canyon floor on the north side of Pajarito Canyon. The petroglyph panel is eligible for preservation on the NRHP. One of the rock shelters is potentially eligible and the other rock shelter is not eligible for preservation on the NRHP.

There are no cultural sites located within the area disturbed by construction of the low-head weir and detention basin. There are several artifact scatters from the Coalition/Classic Periods downstream of the weir; however, these are not within the streambed.

There is one historic site located within approximately 200 ft (60 m) of the road reinforcements at Anchor Ranch Road. However, this site consists of a Homestead Period artifact scatter, such as broken bottles, dishes, cans, and glass, and is not eligible for preservation.

There are several prehistoric sites located in the area of the steel diversion wall. These sites consist of a rock shelter and several cavates. These sites are located along the cliff faces above the canyon floor.

3.7 Geology

The Jemez Mountains volcanic field (JMVF) is located in northern New Mexico at the intersection of the western margin of the Rio Grande Rift and the Jemez Lineament (Figure 21; Gardner et al. 1986, Heiken et al. 1996). The Jemez Lineament is a northeast-southwest trending alignment of young volcanic fields ranging from the Springerville volcanic field in east-central Arizona to the Raton volcanic field of northeastern New Mexico (Heiken et al. 1996). The JMVF is the largest volcanic center along this lineament (ERP 1992). Volcanism in the JMVF spans a roughly 16-million-year period beginning with the eruptions of numerous basaltic lava flows. Various other eruptions of basaltic, rhyolitic, and intermediate composition lavas and ash flows occurred sporadically during the next 15 million years with volcanic activity culminating in the eruption of the Bandelier Tuff (Figure 22) at 1.79 and 1.23 million years ago (Self and Sykes 1996). All of LANL property is within the JMVF and is sited along the western edge of the Rio Grande Rift. Most of the bedrock on LANL property is composed of the salmon-colored Bandelier Tuff.

The geologic structure of the LANL area is dominated by the north-trending Pajarito Fault system. The Pajarito Fault system forms the western structural boundary of the Rio Grande Rift, along the western edge of the Española Basin, and the eastern edge of the JMVF. The Pajarito Fault system consists of three major fault zones (Pajarito, Guaje Mountain, and Rendija Canyon fault zones) and numerous secondary faults with vertical displacements ranging from 80 to 400 ft (24 to 120 m). Estimates of the timing of the most recent surface rupturing paleoearthquakes along this fault range from 3,000 to 24,000 years ago (Gardner et al. 1999, Gardner et al. 2001).

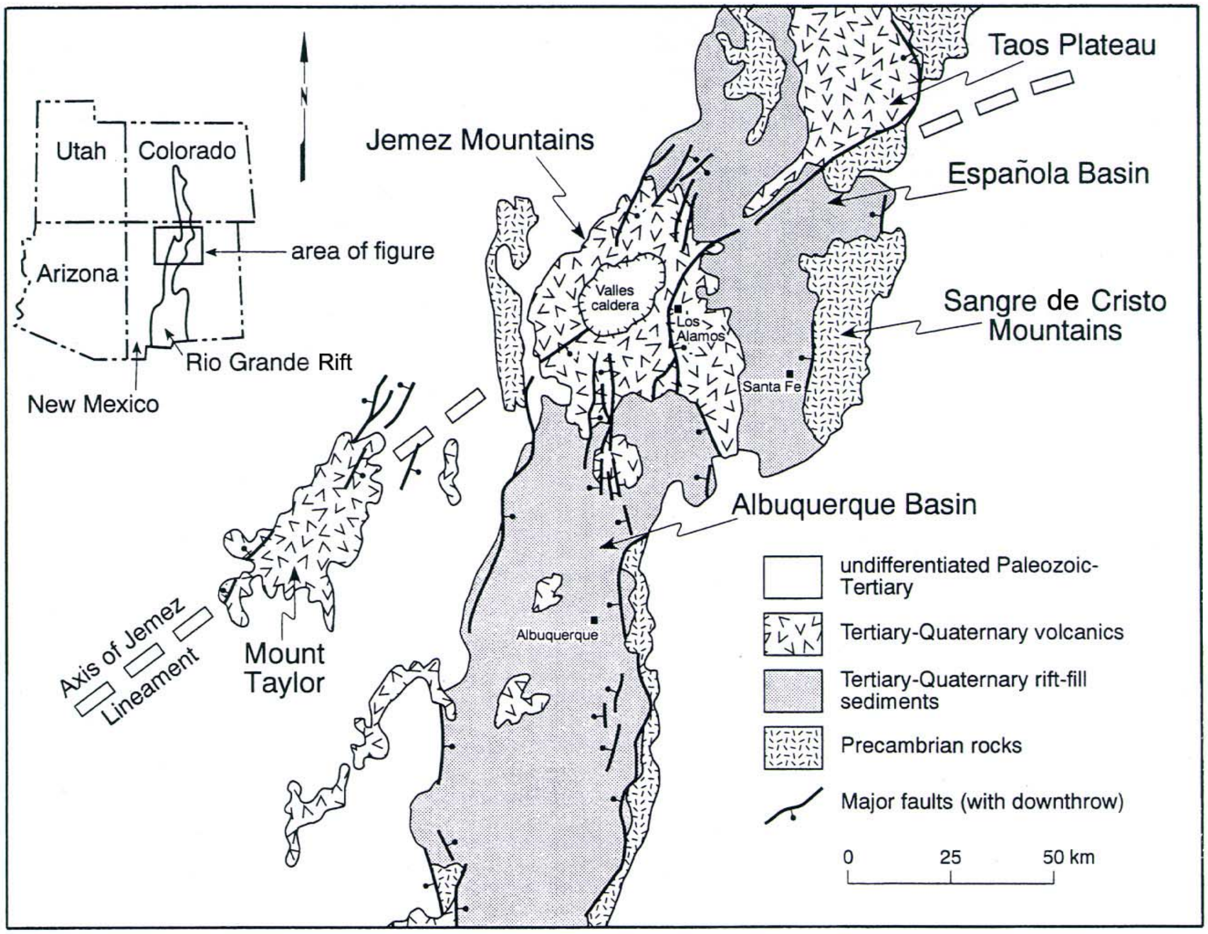

Figure 21. Generalized geologic map of the Rio Grande Rift in northern New Mexico (Self and Sykes 1996).

Results of seismic hazards studies (Wong et al. 1995, Gardner et al. 1999, Gardner et al. 2001) indicate that the Pajarito Fault system represents the greatest potential seismic risk to LANL, with an estimated maximum earthquake magnitude of about 7 on the Richter Scale. Although large uncertainties exist, an earthquake with a Richter magnitude of 6 is estimated to occur once every 4,000 years; an earthquake of magnitude 7 is estimated to occur once every 100,000 years (DOE 1999).

The FRS is constructed within Pajarito Canyon 800 ft (240 m) downstream of the confluence with Two-Mile Canyon. This canyon has been carved into the upper member of the Bandelier Tuff which is known as the Tshirege Member. The Tshirege Member was erupted at 1.23 million years ago during the Quaternary Period. It consists of five “cooling units” of varying thickness (Figure 22). Each “cooling unit” represents a separate, but closely spaced in time, eruption(s) of ash that came to rest and then cooled as a unit and lithified into rock. The FRS is anchored into units 1v and 2 along the sides of the canyon and into units 1v and 1g at the base (see Figure 22). The Tshirege Member is characterized by numerous joints (most related to cooling of the ash) and variable degrees of welding. Unit 3 makes up the upper portions of the canyon walls and the mesa tops in this area. It consists of a lower non-welded portion (slopes)

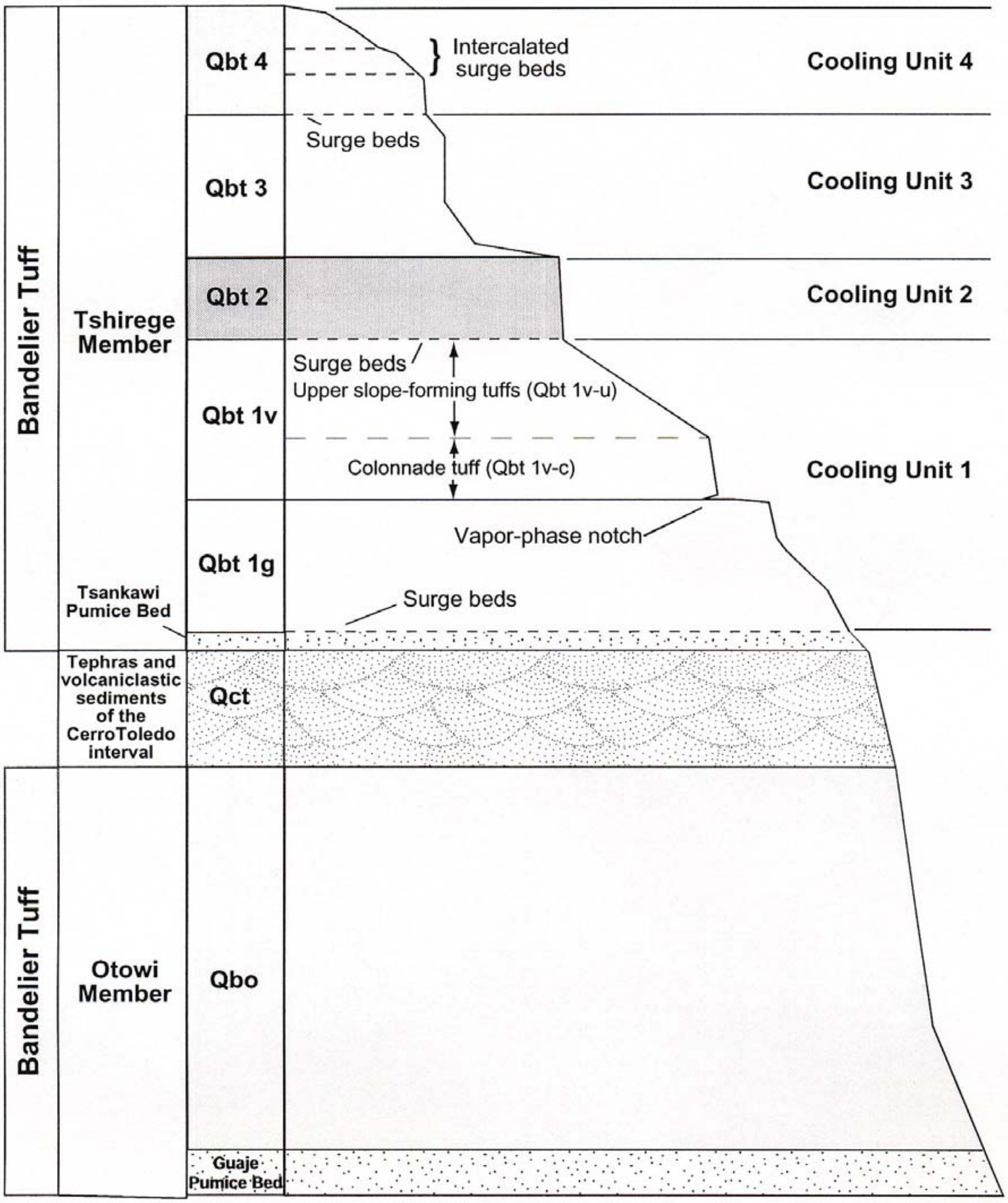

Figure 22. Stratigraphy of the Bandelier Tuff (from Broxton and Reneau 1995).

and an upper welded portion (cliffs). The underlying unit 2 is also a variably welded cliff-former. The lower part of this unit is gradational into the underlying unit 1v. The amount of welding of the units generally increases upwards from non-welded at the base of unit 1g to densely welded at the top of unit 2. In general, the rock is less competent and more friable at the base of Pajarito Canyon and becomes more competent about halfway up the canyon wall near the top of the FRS. This is then repeated in unit 3 to the top of the mesa.

Rockfalls, landslides, and slope instability are triggered by any process that might destabilize supporting rocks. These are the most likely geo-hazards that could affect the proposed action and alternatives. The natural jointing (cooling cracks) mentioned above provides pathways for water, increasing the likelihood of freeze-thaw cycles or excessive rainfalls contributing to rockfalls. Preferential erosion of less welded portions of the tuffs (by streams or rainfall) could undermine the overlying, more densely welded layers (Figure 22) resulting in rockfalls or landslides. Construction activity (creating roads, etc.) could also contribute to slope instability. A study on potential mesa-edge stability at Pajarito Mesa (Reneau 1995) indicates that north rims display large-scale mass movement features in a zone typically 100 ft to 200 ft (30 m to 60 m) wide. In contrast, mass wasting on south rims is dominated by infrequent failure of narrow fracture-bounded tuff blocks. The frequency of failure is unknown but seismic shaking may provide a triggering mechanism. The southern end of the Guaje Mountain Fault Zone has been projected to cross Pajarito Canyon (within the Bandelier Tuff) where Two-Mile Canyon enters (Reneau et al. 1995). However, the projection of the southern end of the Guaje Mountain Fault Zone across Pajarito Canyon is inconclusive. If in fact the fault zone does cross Pajarito Canyon less than 1,000 ft (300 m) upstream of the FRS, the FRS should be considered to be within a zone of increased seismic risk.

The low-head weir and detention basin is constructed within Los Alamos Canyon near the intersection of SR 4 and SR 502. In the vicinity of the weir, this canyon has been carved through the upper and lower members of the Bandelier Tuff (Tshirege and Otowi Members, respectively; see Figure 22) and into the underlying Cerros del Rio basalts. The canyon floor is covered by varying amounts of alluvium (stream sediments) and colluvium (landslide deposits). The low-head weir is constructed upon these unconsolidated sands and gravels. The underlying basalt is fractured in this area, which could provide pathways for ground water to migrate into the regional aquifer.

In the vicinity of the Anchor Ranch Road where it crosses Two-Mile Canyon, the local geology consists of uppermost Bandelier Tuff (Tshirege Member) and fan deposits just to the west of SR 501. The ash flows in this area are stratigraphically higher than unit 4 in Figure 22 (Figure 22 is representative of Pajarito Mesa and not westernmost LANL). These ash flows are generally more densely welded than the ash flows at Pajarito Mesa and contain numerous sandy surge beds. The fan deposits to the west consist of stream-deposited, loose, pre-Bandelier Tuff rock-type material exposed as a result of movement in the Pajarito Fault Zone (Rogers 1995). This area lies directly within the Pajarito Fault Zone (Gardner et al. 1999, 2001) and the 400 ft (120 m) plus, nearly vertical fault scarp is located approximately 700 ft (210 m) to the west. The Pajarito Fault Zone is the western edge of the Rio Grande Rift (Figure 21). The location of these road reinforcements is less than 500 ft (150 m) from several active secondary faults of the Pajarito Fault Zone. As such, this location has an increased risk of seismic events relative to other areas further removed from the fault zone. The proximity of the steep fault scarp immediately to the west could result in high velocity flash floods with high contents of debris (rocks, gravel, trees, etc.) that could have significant erosion effects in the event of heavy rainfall.

The steel diversion wall is constructed within Pajarito Canyon downstream from the FRS near CASA 1 at TA-18. In this area the canyon has been carved into the upper member of the Bandelier Tuff (Tshirege Member; Figure 22). The diversion wall is constructed upon alluvium and volcanic tuff and is designed to divert water to the south of CASA 1.

3.8 Water Resources (Ground and Surface)

Surface water at LANL occurs primarily as short-lived or intermittent reaches of streams. Perennial springs on the flanks of the Jemez Mountains supply base flow into the upper reaches of some canyons, but the volume has been insufficient to maintain surface flows across LANL. Runoff from heavy thunderstorms or heavy snowmelt can reach the Rio Grande. Effluents from sanitary sewage, industrial water treatment plants, and cooling tower blow-down enter some canyons at rates sufficient to maintain surface flows for varying distances (DOE 1999). Surface waters at LANL are monitored by LANL and the NMED to survey the environmental effects of LANL operations. Planned releases from industrial and sanitary wastewater facilities within LANL boundaries are controlled by NPDES permits. Construction, maintenance, and environmental activities conducted within water courses are carried out under *Clean Water Act* Section 404 permits certified per section 401 as regulated by NMED. The NMED also requires the application of BMPs to ensure compliance with New Mexico stream standards for activities conducted within or next to water courses.

The nature and extent of groundwater within the LANL region have not been fully characterized. Current data indicate that groundwater bodies occur near the surface in the canyon bottom alluvium, perched at deeper levels within the alluvium, and at still deeper levels in the regional aquifer (Purtymun 1995). Alluvial groundwater bodies have been identified primarily by drilling wells in locations where impacts from LANL operations are most likely to occur (DOE 1999). On LANL property, continually saturated alluvial groundwater bodies occur in Mortandad, Los Alamos, Pueblo, Sandia, and Pajarito Canyons. The depth to these alluvial groundwater bodies varies from approximately 90 ft (27 m) in the middle of Pueblo Canyon to 450 ft (135 m) in lower Sandia Canyon (LANL 1993). The main aquifer is separated from the alluvial groundwater bodies by 350 to 620 ft (105 to 186 m) of unsaturated volcanic tuff and sediments (Purtymun 1995). The aquifer is relatively insulated from the alluvial groundwater bodies and the perched groundwater bodies by these geologic formations. Recharge of the aquifer is not fully understood nor characterized. Groundwater within the LANL area is monitored to provide indications of the potential for human and environmental exposure from contaminants (DOE 1999). Groundwater protection and monitoring requirements are included in DOE Order 5400.1, General Environmental Protection Program (DOE 1988).

Data and analysis of LANL surface and groundwater quality samples taken from test wells indicate that LANL operations and activities have affected the surface water within LANL boundaries and some of the alluvial groundwater zones in the LANL region as well. Details on the surface and groundwater quality can be found in the annual LANL Environmental Surveillance and Compliance Report (LANL 2001d).

High- and moderate-severity fire increases the potential for surface runoff and soil erosion by removing vegetation and surface organic layers and increasing soil hydrophobicity. The Cerro Grande Fire increased the potential for storm water runoff through the canyons. For example, in Pueblo Canyon (one of the most severely burned areas), peak flows increased 16 times over pre-fire conditions. Details of flow rate increases can be found in DOE/SEA-03 (DOE 2000a). Studies are currently underway using data obtained from gaging stations, rainfall, vegetation regrowth, and other sources to model how water flows and sedimentation rates will change over the years as the forests recover from the fire. The data collected so far show little recovery. Peak flows observed in gauging stations in Los Alamos Canyon before the Cerro Grande Fire were usually less than 20 to 30 cubic feet per second (cfs). Peak flows modeled for the 100-year flood event after the fire can be as high as 1,300 cfs (Springer 2002). Similar studies have been done in Pajarito Canyon. At SR 501, observed flows before the Cerro Grande Fire were reported at 2.4 cfs. An estimated flow rate from a storm on June 28, 2000, was 1,020 cfs, and modeling of the 100-year flood event after the fire reports 2,063 cfs. With increased runoff and erosion, the potential for the migration of chemical, radiological, and heavy metal constituents throughout the canyons has also increased.

3.9 Human Health

The health of UC workers and non-UC demolition and maintenance workers is considered in this EA because each category of worker would be involved in the demolition or breeching of a portion of the FRS or the maintenance of other flood control structures under the Proposed Action. Members of the public are not considered because they are not likely to be affected by demolition activities, routine maintenance, or any credible accident scenarios that could result from the Proposed Action.

The health of UC workers is routinely monitored depending upon the type of work performed. Health monitoring programs for UC workers consider a wide range of potential concerns including exposures to radioactive materials, hazardous chemicals, and routine workplace hazards. In addition, UC workers involved in hazardous operations are protected by engineering controls and required to wear appropriate personal protective equipment (PPE). Training is also required to identify and avoid or correct potential hazards typically found in the work environment and to respond to emergency situations. Because of the various health monitoring programs and the requirements for PPE and routine health and safety training, UC workers are generally considered to be a healthy workforce with a below average incidence of work-related injuries and illnesses.

UC staff monitors environmental media for contaminants that could affect non-UC workers or members of the public. This information is reported to regulatory agencies, such as the NMED, and to the public through various permits and reporting mechanisms and it is used to assess the effects of routine operations at LANL on the general public. For detailed information about environmental media monitoring and doses to the public, see LANL's Environmental Surveillance and Compliance Report for 2000 (LANL 2001d). For those persons that work within the boundaries of LANL as subcontractors or demolition workers and could be exposed to radioactive or other hazardous materials, their exposures are monitored in the same manner as UC workers. In addition, site-specific training and PPE requirements would also apply to these workers.

3.10 Noise

Noise is defined as unwanted sound. Sound is a form of energy that travels as invisible pressure vibrations in various media, such as air. The auditory system of the human ear is particularly sensitive to sound vibrations. Noise is categorized into two types: *steady-state noise*, which is characterized as longer duration and lower intensity, such as a running motor, and *impulse or effect noise*, which is characterized by short duration and high intensity, such as the detonation of high explosives (HE). The intensity of sound is measured in decibel (dB) units. In sound measurements relative to human auditory limits, the decibel scale is modified into an A-weighted frequency scale (dBA).

Noise measured at LANL is primarily from occupational exposures. These measurements generally take place inside buildings and are made through the use of personal noise dosimeters and other noise monitoring instruments. Occupational exposure data are compared against an established occupational exposure limit (OEL). At LANL, the OEL is administratively defined as noise to which a worker may be exposed for a specific work period without probable adverse effects on hearing acuity. The OEL for both steady-state and impulse or effect noise is based on U. S. Air Force Regulation 161-35, *Hazardous Noise Exposure*, which has been adopted by DOE. The maximum permissible OEL for steady-state noise is 84 dBA for each 8-hour work period. The OEL for impulse and effect noise is not fixed because the number of effects allowed per day varies depending on the dBA of each effect. DOE also requires that Action Levels (levels of exposure to workplace hazards that are below the OEL but require monitoring or the use of PPE) be established for noise in the workplace. Action Levels at LANL for steady-state noise and impulse and effect noise are 80 dBA and 140 dBA for each 8-hour day, respectively.

Environmental noise levels at LANL are measured outside of buildings and away from routine operations. These sound levels are highly variable and are dependent on the generator. The following are typical examples of sound levels (dBA) generated by barking dogs (58), sport events (74), nearby vehicle traffic (63), aircraft overhead (66), children playing (65), and birds chirping (54). Sources of environmental noise at LANL consist of background sound, vehicular traffic, routine operations, and periodic HE testing. Measurements of environmental noise in and around LANL facilities and operations average below 80 dBA.

The averages of measured values from limited ambient environmental sampling in Los Alamos County were found to be consistent with expected sound levels (55 dBA) for outdoors in residential areas. Background sound levels at the White Rock community ranged from 38 to 51 dBA (Burns 1995) and from 31 to 35 dBA at the entrance of Bandelier National Monument (Vigil 1995). The minimum and maximum values for the County ranged between 38 dBA and 96 dBA, respectively. Because of the isolated locations of the FRS and the various other flood control structures, ambient noise levels in the vicinity of these structures is typical of undeveloped outdoor areas.

3.11 Traffic and Transportation

Section 4.10 of the LANL SWEIS (DOE 1999) describes transportation services at LANL before the Cerro Grande Fire. The impacts on transportation in and around LANL under the Preferred Alternative selected in the SWEIS ROD are described in detail in Section 5.3.10 of the SWEIS. Motor vehicles continue to be the primary means of transportation to LANL. Only two major roads, SR 502 and SR 4, access Los Alamos County (see Figure 3). Peak traffic volume on these two segments of highway is primarily associated with LANL activities. Commuter traffic to LANL from the east, mainly the Rio Grande Valley or Santa Fe, travels on SR 502 to the town sites, or exits SR 502 to SR 4, which passes near the Los Alamos Canyon low-head weir (Structure 2 on Figure 3) and then travels on East Jemez Road or Pajarito Road to various TAs within LANL. Commuters from White Rock also access East Jemez Road and Pajarito Road from SR 4. Pajarito Road runs past the access roads and lay-down areas proposed for the FRS. A small percentage of LANL employees commute to LANL from the west along SR 501, where the road reinforcements are located.

Hazardous and radioactive material shipments leave or enter LANL from East Jemez Road to SR 4 to SR 502, and thus pass near the Los Alamos Canyon low-head weir. On-site shipments take place on Pajarito Road, which runs past the access roads to the FRS and to TA-18 where the steel diversion wall is located above CASA I.

Traffic and transportation from construction and demolition activities at LANL result in increased trips by construction workers traveling to and from work. Transportation of construction materials and debris to and from the construction and demolition sites also result in additional trips.

3.12 Visual Resources

The visual environment of LANL is described in the SWEIS (DOE 1999). The natural setting of the Los Alamos area is panoramic and scenic. The mountain landscape, unusual geology, varied plant communities, and archaeological heritage of the area create a diverse visual environment. Portions of the viewshed underwent substantial changes as a result of the Cerro Grande Fire. The fire burned large areas of the mountain slopes that form the principal scenic background in the Los Alamos area. The resulting landscape is both more stark and less uniform than before the fire (DOE 2000a).

The FRS rises 72 ft (21.6 m) above the natural canyon floor and stretches 390 ft (117 m) across Pajarito Canyon. The FRS does not rise above the canyon walls and thus is not visible from nearby roadways or public access areas. The FRS is within an access-restricted area. It does not disrupt any vistas or affect any local recreational areas.

The low-head weir and sediment detention basin are visible from SR 4. Although they are not high enough to obscure scenic vistas, they do represent a small-scale visual disruption of an otherwise minimally developed area.

The road reinforcements represent local changes in the visual environment. These changes are similar to other engineered highway structures, such as culverts, slope stabilizing walls, and traffic barriers. None of the road reinforcements interferes with scenic vistas.

The steel diversion wall is located in a developed area with restricted access. It is not visible from nearby roadways.

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